



Collaborative Co-design of Sensing, Communication, and Control Leveraging Spatio-temporal Sparsity of Visual Information:

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Grand Challenge and Goal:

Establish a next-generation real-time, energy-efficient information infrastructure by collaboratively designing sensing, communication, and control with event camera-Fourier optics fusion sensors that exploit visual spatiotemporal sparsity

Summary:

- Conventional visual control systems periodically process all pixels from camera video data to determine control inputs
- However, control requires only the meaningful changes in visual information that truly affect control inputs, rather than the entire video stream
- This research aims to achieve both real-time performance and energy efficiency by extracting and processing only these meaningful changes
- Specifically, we develop collaborative co-design methods for sensing, communication, and control using Event camera-Fourier Optics fusion (EFO) sensor to establish a next-generation information, communication, and control infrastructure

Social Impact:

- Enable advanced, responsive automation for autonomous vehicles and robots
- Reduce power consumption by 70–90%, contributing to energy savings and CO₂ reduction
- Provide design guidelines for drones, medical robots, and related applications
- Promote standardization through industry-academia collaboration

